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**NOTES ON THE DISTRIBUTION OF COLORADO MAMMALS, WITH A DESCRIPTION
OF A NEW SPECIES OF BAT (*EPTESICUS PALLIDUS*) FROM BOULDER.**

BY ROBERT T. YOUNG.

In the following article I propose (1) to discuss briefly the distribution of the mammals of the mountains of northern central Colorado in their relation to the life zones of that region;¹ (2) to point out the apparent movement of some species relative to their centers of dispersal and to give a few facts regarding the little known distribution of certain forms in this State, and (3) to describe a new species of bat from Boulder.

(1) Distribution of mammals relative to the life zones of northern central Colorado.

In two recent papers by Ramaley² and myself³ the life zones of the Rocky Mountains in this region, as determined by the flora, have been mapped out. Does the mammalian fauna of the mountains show the same zonation as does the flora?

The zones as outlined by Ramaley are as follows:

1. Plains Zone, below 5,800 feet.
2. Foothill Zone, from 5,800 to 8,000 feet.
3. Montane Zone, from 8,000 to 10,000 feet.
4. Sub-alpine Zone, from 10,000 to 11,500 feet.
5. Alpine Zone, from 11,500 to 14,000 feet.

The first of these not being a mountain zone may be omitted from our discussion. The last four correspond to the zones which I, in accordance with the terminology of Merriam⁴ and others, have specified as Transition 1,650–2,400 m., Canadian 2,400–2,850 m., Hudsonian 2,850–3,300 m. and Alpine⁵ 3,300–3,450 m.⁶

¹ Where the records for any species number very few, I have usually omitted such species from this part of my discussion.

² Plant Zones in the Rocky Mountains of Colorado, *Science*, N. S., Vol. XXVI, pp. 642–3.

³ Forest Formations of Boulder County, Colorado, *Bot. Gaz.*, Vol. XLIV, pp. 321–52.

⁴ Life Zones and Crop Zones of the United States, Bull. 10, U. S. Biological Survey.

⁵ Merriam applies the term Arctic-Alpine to this zone.

⁶ Ramaley's terminology, as applied to this particular region, is perhaps more desirable than that of Merriam; but for purposes of comparison with other regions, and for the sake of uniformity, I much prefer the latter.

While it is well known that an absolute delimitation of zonal areas in mountain regions is impossible, whether plants or animals are chosen as characteristics, still the zones as outlined above are fairly well defined by their plant inhabitants.

Of the mountain mammals of northern Colorado many range widely from timber line to the plains, and, with a few exceptions, there are none whose range is closely coincident with any one of the zones mentioned above. These exceptions are the following: *Sciurus aberti concolor*, *Citellus variegatus grammurus*, *Citellus elegans*, *Cynomys leucurus*, *Peromyscus truei nasutus*, *Neotoma fallax*, and *Spilogale tenuis* in the Transition zone; and *Lepus americanus bairdi*, *Ochotona saxatilis* and *Phenacomys preblei* in the Hudsonian zone.

The Canadian zone possesses no characteristic mammals. Species ranging through both Hudsonian and Canadian zones, but mainly restricted to them, are the following: *Evotomys gapperi galei*, *Microtus nanus*, *Gulo luscus*, *Mustela americana*, *Putorius streator leptus* and *Putorius arizonensis*.

Boreal species which include the Transition zone within their range are as follows: *Cervus canadensis*, *Ovis canadensis*, *Sciurus fremonti*, *Eutamias amoenus operarius*, *Eutamias minimus consobrinus*,⁷ *Callospermophilus lateralis*, *Marmota flaviventer*, *Neotoma orolestes*, *Microtus mordax*, *Thomomys fessor*, *Thomomys clusius fuscus*, *Zapus princeps*, *Erethizon epixanthus*, *Sylvilagus pinetis*,⁸ *Felis hipolestes*, *Lynx vinta*, *Ursus americanus*, *Sorex obscurus*, *Sorex personatus*, and *Neosorex palustris navigator*. *Vulpes macrourus* should probably be included in this list, but as to its altitudinal limits I have no definite information. Sonoran species extending into the Transition zone are the following: *Odocoileus macrourus*, *Antilocapra americana*, *Mephitis mesomelas varians* and *Putorius longicauda*.

Of general distribution through both Sonoran and Boreal regions may be mentioned the following species: *Odocoileus hemionus*, *Bison bison*,⁹ *Eutamias quadrivittatus*, *Citellus tridecemlineatus pallidus*, *Castor canadensis fondator*, *Peromyscus nebracensis*, *Peromyscus rufinus*, *Microtus pennsylvanicus modestus*, *Lepus campestris*, *Lepus townsendi*, *Canis* sp.,¹⁰ *Taxidea taxus*, *Lutreola lutrecephala energumenos* and *Putorius nigripes*. Both the wild cat and timber wolf ought probably to be included under

⁷ Extends into the Sonoran.

⁸ Also Sonoran to some extent. I have taken it 12 km. east of Boulder on the hot barren plains.

⁹ Now practically extinct.

¹⁰ The distribution of the different forms of coyotes through the mountains is not yet known.

this last heading. I have omitted them, however, because I have no information as to the species of each, and but little as to their distribution.

Thus we find the Alpine zone with no characteristic mammals, the Hudsonian with three, the Canadian with none and the Transition with seven, while there are six Boreal species (*Cervus occidentalis*, *Eutamias m. consobrinus*, *Thomomys clusius fuscus*, *Thomomys fossor*, *Sylvilagus pinetis* and *Neosorex palustris navigator*) and one Sonoran-Boreal form (*Eutamias quadrivittatus*) which probably do not extend much above the Canadian zone, and six which seldom if ever extend below it. In addition to the seven species characteristic of the Transition zone, we find this zone forming the lower limit of eighteen Boreal species and the upper limit of four Sonoran forms.

While the Alpine zone possesses many characteristic plants, on the mammalian side it is characterized chiefly by the paucity of its fauna, possessing not a single characteristic species. The Hudsonian and Canadian zones have most of their mammals in common, while of the three species characteristic of the former zone, *Ochotona saxatilis*¹¹ invades the latter to some extent, while on the other hand it occurs in the Alpine zone in suitable places.

These facts bring out very clearly, I believe, the distinctness of Boreal and Sonoran regions in northern Colorado, as based on the distribution of the mammals in this territory. The Transition zone is, as its name implies, a meeting ground of these two great regions, common to, and yet distinct from each. They show further the intimate relation between Hudsonian and Canadian zones. Using the mammals only as a criterion, I hardly believe we should be justified in separating these zones from each other; their characteristics are relatively much fewer than among the plants.

(2) The movement of some species relative to their centers of dispersal and notes on the little known distribution of certain forms.

The occurrence of a species outside its proper habitat does not necessarily prove a migration on the part of that species from such habitat. It may, on the contrary, mean that the species formerly had a more widespread distribution than at present, becoming secondarily restricted to its present habitat, with the exception of a few stragglers remaining in the territory formerly occupied by it. This is a question which cannot, in most cases, be settled with our present lack

¹¹ Warren, E. R.: The Mammals of Colorado, *Colorado College Publications*, Science Series, No. 46, p. 254, mentions the coney as occurring as low as 2,834 m. near Crested Butte.

of data regarding the former abundance of the species in the region in question. Where, however, a typical plains form, as *Putorius nigripes* or *Citellus tridecemlineatus pallidus*, is found in the higher mountains, I believe we are justified in concluding that they have migrated outside of their proper habitat.

Sciurus ludovicianus.

This species is now quite common in the neighborhood of Greeley, where I understand it has been introduced from Omaha. It is also present in Denver.

Citellus tridecemlineatus pallidus.

The presence of this spermophile at Divide,¹² altitude 3,000 m., and elsewhere in the mountains,¹³ indicates a westward and upward movement of this species from its center in the Great Plains, probably dependent upon the presence of its physical habitat, the grass-sagebrush plains in some parts of the mountains, rather than upon temperature.

Peromyscus nebracensis.

This is another plains form of Upper Sonoran and Transition zones which appears to be invading the mountains, judging by its occurrence at an altitude of 3,508 m.¹⁴ and elsewhere through the mountains.

Phenacomys preblei.

The only record hitherto of this species is that given by Merriam¹⁵ from Long's Peak. I have taken a single specimen on North Boulder Creek at about 2,900 m. altitude. This is the only specimen I have secured in spite of careful trapping in several places.

Spilogale tenuis.

I have taken a few of this species at Boulder, hitherto known only from Arkins and Estes Park.

Putorius nigripes.

The occurrence of the black-footed ferret at an altitude of 3,124 m.¹⁶ indicates a probable migration on its part from its habitat on the plains into the mountains.

¹² *Fide* Warren (*op. cit.*, p. 242).

¹³ Bailey, V: The Prairie Ground Squirrels of the Mississippi Valley, Bull. 4, U. S. Biol. Survey, gives its western limits as approximately Twin Lakes.

¹⁴ *Fide* Warren (*op. cit.*, p. 245).

¹⁵ Merriam, C. H.: *Phenacomys preblei*, a New Vole from the Mountains of Colorado, *Proc. Biol. Soc. Wash.*, Vol. XI, p. 45.

¹⁶ *Fide* Warren (*op. cit.*, p. 264).

Putorius longicauda.

This weasel invades the mountains also to some extent, as I have observed it in Boulder Canyon several miles above its mouth.

Sorex personatus.

The occurrence of this shrew in the Rocky Mountains as far south as Colorado extends considerably southward in these mountains the range of this northern and eastern form. Its presence in the meadows about Boulder brings this Boreal species down to the edge of the Upper Sonoran zone.

Sorex personatus haydeni.

Warren¹⁷ records a specimen of this shrew taken by him at Lake Moraine and identified by Merriam. Inasmuch as *haydeni* is a North Dakota plains form its occurrence in the Hudsonian zone on Pike's Peak is certainly interesting. Have we here a marked case of migration, a case of polygenesis, or is *haydeni*, as Elliott¹⁸ believes, a synonym for *personatus*?

Sorex vagrans dobsoni.

This is another interesting record given by Warren¹⁹ and based on an identification by Merriam. In *N. A. Fauna*, No. 10, p. 68, the latter gives the distribution of this shrew as parts of Idaho, Montana, Wyoming and Utah. He says further in the same place: "The interrelations of *dobsoni* and *obscurus* are intricate and perplexing. The two animals resemble one another very closely, but no intergrades have been found, and each has, so far as known, an independent distribution." This record extends the range of *dobsoni* considerably southward, making it coincident, at this point at least, with that of *obscurus*.

Sorex obscurus.

Merriam²⁰ gives the distribution of this species as "Restricted to Boreal Zone." Specimens collected by me at Boulder extend its range through the Transition zone.

Corynorhinus macrotis pallescens.

I have a specimen taken in Boulder Canyon at an approximate altitude of 2,300 m., which shows an occasional invasion of the Transition zone by this supposedly Sonoran species.

¹⁷ *Op. cit.*, p. 265.

¹⁸ Elliott, D. G.: A Synopsis of the Mammals of North America and the Adjacent Seas, *Field Columbian Museum*, Zool. Ser., II, 1901, p. 367.

¹⁹ *Op. cit.*, p. 266.

²⁰ *Op. cit.*, p. 72.

Myotis lucifugus longierus.

The only Colorado record of this bat which I have found is one by Miller²¹ for Grand Junction. I have taken it at Steamboat Springs, and have a badly mutilated skin from Eldora which is probably one of this species.

Myotis evotis.

The only Colorado record I have seen is one by Miller²² from Loveland. I have a specimen taken in the Yellow Jacket Mountains 21 km. east of Steamboat Springs at an approximate altitude of 2,140 m.

(3) Description of a new species of bat from Boulder.

***Eptesicus pallidus* sp. n.**

Type No. 142,526 ♀ ad., collection of U. S. Nat. Mus. Collected by R. T. Young at Boulder, Colorado, July 22, 1903.

Distribution.—Known from type locality only.

Diagnosis.—Skull identical with that of *Eptesicus fuscus*. Size largest of American species of the genus. (Average total length of four specimens, all females, 124.)²³

Color palest of American species of the genus, distinctly lighter than that of *E. fuscus*.

Color.—Above brownish ashy, the basal half of hairs fuscous; below pale silvery gray, the basal half of hairs fuscous, with a narrow transition zone of brownish ashy between the inner and outer parts. Dorsally and ventrally along the line of attachment, and on the surfaces of the membranes, the basal fuscous zone of the hairs disappears.

Measurements of Type.—Total length, 127; tail, 50; hind foot, 12. Skull, occipito-nasal length, 19; interorbital constriction, 4; zygomatic breadth, 13; upper tooth row, 8.5; palato-basi-occipital length, 15; mandible (from condyle to symphysis), 14; lower tooth row, 9.

Measurements (average of four females).—Total length, 124; tail, 49; hind foot, 12.²⁴ Average of two females in alcohol: Ear from crown, 13.5; tibia, 20.5; forearm, 49; thumb, 8; longest "finger," 80.5,²⁵ width of ear, 11.5; tragus (from posterior angle), 8. Skull (average of three specimens),²⁶ 18.5, 4, 12.5,²⁷ 8, 14.5, 13.5, 9.

Remarks.—While conclusions based on so small a number of specimens as I possess are necessarily uncertain, still I believe that, since

²¹ Miller, G. S., Jr.: Revision of the North American Bats of the Family Vespertilionidae, *N. A. Fauna*, 13, p. 65.

²² *Op. cit.*, p. 80.

²³ All measurements in mm.

²⁴ Average of five specimens including one male.

²⁵ From tip to base of phalanges not including carpus.

²⁶ Measurements given in same order as those of the type.

²⁷ Average of two specimens.

specimens of *Eptesicus fuscus* from this region²⁸ have the color and size typical of the species, the new form must be considered as a distinct species and not merely a geographical race of *fuscus*.

The probable origin of this species is a matter of some interest. Occurring in the same territory and occupying the same habitat as its near relative *fuscus*, neither the geographic isolation nor selection theory seem to offer a satisfactory explanation. Neither the mutation nor orthogenesis theory finds any difficulty in these facts. Moreover we have here an apparent exception to Jordan's law of geminate species.

Further information as to the distribution of this species is very desirable.²⁹

In conclusion I wish to thank the authorities of the Field Museum, the Academy of Natural Sciences of Philadelphia and the U. S. National Museum for the identification of much of my material; and the latter institution especially for its loan of valuable material.

²⁸ Loveland, *vide* Miller, *op. cit.*, p. 98. A single skin without skull in my own collection from Boulder Canyon, approximate altitude 2,300 m., has the typical brown color of *E. fuscus*.

²⁹ Miller, *op. cit.*, p. 99, says of *fuscus*: "Very pallid specimens are occasionally taken in the Southwestern United States, but the number of skins available for comparison is so small that it is impossible to determine the status of the form which these aberrant individuals represent." It is possible that these specimens are representatives of my new form, but not having seen them I cannot say.